

I claim:

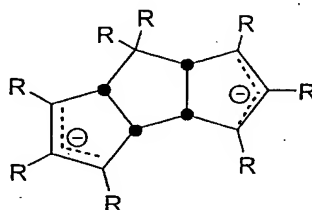
1. A catalyst system useful for polymerizing olefins which comprises an activator and an organometallic complex, wherein the complex comprises a Group 3-10 transition metal and at least one chelating, dianionic triquinane ligand that is pi-bonded to the metal.

2. The catalyst system of claim 1 wherein the activator is selected from the group consisting of alkyl alumoxanes, alkylaluminum compounds, aluminoboronates, organoboranes, ionic borates, and ionic aluminates.

3. The catalyst system of claim 1 wherein the complex includes a Group 4 transition metal.

4. The catalyst system of claim 1 wherein the complex includes a Group 8-10 transition metal.

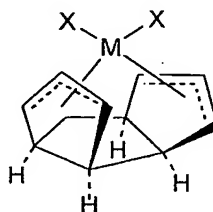
5. The catalyst system of claim 1 wherein the triquinane ligand has the structure:



in which each R is independently hydrogen, halide, or C<sub>1</sub>-C<sub>30</sub> hydrocarbyl.

6. The catalyst system of claim 5 wherein each R is a hydrogen.

7. The catalyst system of claim 1 wherein the complex has the structure:



in which M is a Group 4 transition metal and each X is a halide.

8. The catalyst system of claim 1 wherein the triquinane ligand is prepared from cyclopentadiene and p-benzoquinone in a sequence of steps that includes tandem Diels-Alder, photochemical [2+2] cycloaddition, and [2+2] thermal cycloreversion reactions.

9. A method for preparing an organometallic complex useful for olefin polymerization, said method comprising:

- (a) converting a pentacyclic diketone to a triquinane diene;
- (b) doubly deprotonating the triquinane diene to produce a triquinane dianion; and
- (c) reacting the dianion with a transition metal source to give an organometallic complex that incorporates a chelating, dianionic triquinane ligand.

10. The method of claim 9 wherein the pentacyclic diketone is produced by (a) reacting a cyclopentadiene and a p-benzoquinone to produce a Diels-Alder adduct; and (b) photolyzing the Diels-Alder adduct to effect a [2+2] cycloaddition reaction to give the pentacyclic diketone.

11. The method of claim 9 wherein step (a) is accomplished by first heating the pentacyclic diketone to cause a [2+2] cycloreversion reaction to give a *cis,syn,cis*-triquinane bis(enone), followed by conversion of the bis(enone) to the triquinane diene.

12. The method of claim 11 wherein the bis(enone) is converted to the triquinane diene by (a) reacting the bis(enone) with an arylhydrazine to produce an arylhydrazone; and (b) reducing the arylhydrazone to the diene by reacting it with an alkali metal cyanoborohydride or catecholborane.

13. The method of claim 11 wherein the bis(enone) is converted to the triquinane diene by reacting it with a trialkylhydrosilane in the presence of a Lewis acid.

14. The method of claim 9 wherein step (a) is accomplished by first converting the pentacyclic diketone to a pentacyclic hydrocarbon by

reducing the carbonyl groups to methylene groups, and then heating the pentacyclic hydrocarbon to cause a [2+2] cycloreversion reaction to give the triquinane diene.

**15.** The method of claim 9 wherein the pentacyclic diketone is homologated by reacting it with diazomethane prior to conversion to the triquinane diene.

**16.** A method for preparing an organometallic complex useful for olefin polymerization, said method comprising:

- (a) reacting a cyclopentadiene and a p-benzoquinone to produce a Diels-Alder adduct;
- (b) photolyzing the Diels-Alder adduct to effect a [2+2] cycloaddition reaction to give a pentacyclic diketone;
- (c) converting the pentacyclic diketone to a triquinane diene;
- (d) doubly deprotonating the triquinane diene to produce a triquinane dianion; and
- (e) reacting the dianion with a transition metal source to give an organometallic complex that incorporates a chelating, dianionic triquinane ligand.

**17.** The method of claim 16 wherein the Diels-Alder adduct is produced from cyclopentadiene and p-benzoquinone.

**18.** A process which comprises polymerizing an olefin in the presence of the catalyst system of claim 1.

**19.** A process which comprises polymerizing ethylene with at least one  $\alpha$ -olefin in the presence of the catalyst system of claim 1.